

IV., the deformity of VII., while III. was released. Experiments V. and VIII. were also upon the same species of Mantis. The first, a male, became weak and probably blind after eating a few *Acræas*; the second, a female, remained apparently healthy after an exclusively *Acræine* diet for fourteen days. It is very unfortunate that this latter experiment could not be continued. It is, however, clear that in the case of this species and sex a purely *Acræine* diet for fourteen days is not necessarily unwholesome. Experiments IX., X., and XI. were upon species which were the same, or nearly the same, and all females. The first died after an *Acræa* diet for twenty days, the second was perfectly healthy after a mixed butterfly diet without *Acræinæ* and *Danainæ* for fifteen days, while the third lived healthily from April 3 to September 8 upon *Acræas* and *Limnas chrysippus*. The latter seems to be an insuperable difficulty, but it must be remembered (1) that *chrysippus* was given in especially large numbers, and there is no evidence that *Danainæ* are much rejected by *Mantidæ*, (2) that the Mantis may have recovered from the effect of the *Acræas* during the long fasts, (3) that the *Acræa* chiefly made use of, *A. caldarena*, may be less unwholesome than the majority of the group.

More experiments are greatly wanted, but Mr. Marshall's observations render it highly probable that *Acræas* are unwholesome to *Mantidæ*. The definiteness of the symptoms exhibited, and especially the effect upon the eye, constitute not unimportant evidence in support of this conclusion. The appearance of an opaque blotch in the left eye of three of the Mantises (V., VII., IX.) suggests further experiments in order to test whether we have to do with mere coincidence or a phenomenon of deeper significance.

Mr. Marshall's conclusions from his experiments were written upon the results obtained with spiders as well as Mantises, and will be found at the end of the section upon the former (p. 322).

4. EXPERIMENTS ON SPIDERS IN THE KARKLOOF.

(G. A. K. M.) Natal, February 1897.

[The Rev. O. Pickard-Cambridge, F.R.S., informs me that the species made use of was the common and widely-distributed Epeirid *Nephilengys malabarensis*, Walck.—E. B. P.]

The spiders experimented on were all of one species with very large females and minute males. Their webs were all round the verandah, where they were strictly preserved by Mr. Ball. I never saw the species in the bush.

1. Gave a spider (A) a specimen of *Acræa horta* (entire); she ran down and bit the thorax, then pulled it out of the web and dropped it. At the same time gave *A. horta* with its wings cut off to another spider (C) of the same species, which ate it without hesitation.

2. Gave *horta* without wings to four spiders (A, B, D, and E), and also one in which half the wings had been cut off to C. All were eaten readily.

3. Gave entire males of *horta* to A and B, and both were at once rejected.

4. Wingless specimens of *L. chrysippus* given to A and C were at once thrown out of their webs.

5. The following wingless specimens were given to this species:—*Papilio brasidas* to A, *P. ophidicephalus* to B, *P. euphranor* to C, *P. ophidicephalus* to D, *Eurytela hiarbas* to E, and *P. lyæus* to F. All of them were promptly eaten.

6. Caught a female *horta*, rubbed all the colour off its wings, leaving them entire, and gave it to A, which after careful examination wrapped it up and carried it off to eat.

7. Gave A a perfect male *horta*; she ran down and bit it in the thorax and ejected it from the web. I then rubbed all the colour off the wings and returned it. The spider approached it carefully feeling round with her palpi, and again cut the butterfly loose. I then gave it to B, which also refused it. I then cut the wings off and gave it to B again, with the same result. Finally I gave it to A again, but she pulled it out of the web by the abdomen and dropped it.

8. Gave wingless specimens of *Papilio demodocus* to B and C. Both were eaten.

9. Gave a perfect female *horta* to D, which bit it several times, being seemingly rather doubtful about it, but eventually wrapped it up and carried it off to her chamber. After a short time she threw it down, the butterfly being still alive.

10. On two occasions saw dead specimens of *A. horta* in spiders' webs in the bush. They were both wrapped up, but evidently had not been sucked.

11. Cut off the wings of three male *horta* and gave them to A, B, and C, but they were all rejected. Gave one of the same specimens to D, which carried it off to eat, and was still sucking it when observed two and a half hours afterwards.

12. Gave a wingless *Amauris echeria* to A, which came down very cautiously and bit it in the thorax as usual. Its taste was evidently unpleasant, as in extricating the butterfly from the web it carefully abstained from biting any part of the body. I then put the same specimen in B's web; she ran down at once and tackled it. After giving it a few bites she paused as though in doubt, then, as if thinking it was worth trying, she wrapped it up and drew it up after her to her chamber. She was clearly still doubtful, as she remained several minutes without attempting to touch it. She then sucked it for a few seconds, but soon let it drop. Gave the same specimen to D, and it was rejected. Gave another wingless specimen to C, which also was rejected.

13. Gave entire specimens of *Terias brigitta* to B, C, and D, and also female *Nepheronia argia* (*agathina* form) to A. All were eaten readily. Subsequently gave entire *P. sesamus* (*natalensis* form) to C, which was also eaten.

14. Gave a perfect male *horta* to D. She ran down, bit it in the thorax as usual, wrapped it up and carried it off. She then remained some minutes without attempting to touch it, then after sucking it for a few seconds she threw it away. (Compare Experiments 9 and 11.)

15. Gave a wingless *Acræa violarum* to spiders B, C, and D, in succession. It was promptly ejected by each of them.

16. Gave entire specimens of *A. horta* to spiders A, B, C, and D. The two former ejected theirs at once; C cut hers loose from the web, and was holding it in her jaws preparatory to throwing it away, when she seemed suddenly to change her mind and ran up to her chamber with it, without however enshrouding it with web. She remained with it in her mouth for about half a minute, and then threw it down. D took no notice whatever of the insect in her web.

17. Gave male *Acræa buxtoni* to A, and female *Nepheronia argia* (*agathina* form) to C. Both were eaten.

18. Gave *Pontia hellica* to B, *Papilio demodocus* to C, and

Planema esebria to D. All of them were eaten, though D seemed a little suspicious at first.

19. Gave *Byblia goetzius-acheloia* to A, which ate it readily, although she was a long time before coming down to see what it was.

20. Gave wingless specimens of *A. horta* to spiders A, B, C, and D (six days since last were given—Experiment 16). The first three promptly ejected them, but D wrapped hers up and carried it off. She did not seem very enthusiastic about it however, for she turned it over and over a good many times, giving it a bite here and there, and then left it alone for some time. This procedure she repeated several times, and then threw it away.

21. Gave entire males of *Acrwa serena-buxtoni* to spiders A, C, and D, all of which were eaten. It should be noted that experiments with this species are unsatisfactory, owing to the fact that when captured it is able voluntarily to exude from the thorax its bitter yellow juice, and therefore when given to spiders it has lost much of its nauseous quality, and would be less distasteful than if caught by them direct.

5. RESULTS OF EXPERIMENTS ON SPIDERS AND THE EARLIER EXPERIMENTS ON MANTIDÆ: ONE PROBABLE MEANING OF TENACITY OF LIFE IN DISTASTEFUL INSECTS. (G. A. K. M.)

Malvern, Natal; February 21, 1897.—The danger of arguing from insufficient materials was clearly shown me in my first few experiments on spiders with *A. horta* (Experiments 1, 2, 3, and 6). When I had got thus far I felt sure I had got proofs of the appreciation of warning colours by the spiders. For in these experiments they ate every specimen without wings and refused all those with them except one which had the colour rubbed off. Yet subsequent experiments have convinced me that both spiders and Mantises have no appreciation of warning colours; and this fact has elucidated another which often puzzled me, I mean the apparently constant correlation between distastefulness and tenacity of life in Lepidoptera. At first sight it would seem that tenacity of life or the power to recover after severe injury would be useful to any species in the struggle for existence. But a little thought showed me that this power would be of no use to edible species, as if once caught by insectivorous animals